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ENVIRONMENTAL SITE ASSESSMENT WITH TRANSMITTAL NTC ORLANDO FL
7/15/1996
ECG, INC.

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Technical, Engineering and Management Services

July 15, 1996

US Army Corps of Engineers District, Jacksonville
CE-SAJ-PD-EE (Peter Besrutschko)
P. O. Box 4970
Jacksonville, Florida 32232-0019

RE: Environmental Assessment
Orlando Executive Airport
Orlando, Florida
DACWIT-96-D-0009, Delivery Order No. 1

Dear Mr. Besrutschko;

ECG, Inc. is pleased to provide the US Army Corps of Engineers with this draft report of the environmental assessment conducted on the Orlando Executive Airport.

The enclosed report summarizes our methodology, procedures, and findings and presents conclusions and recommendations drawn from information developed during the course of the investigation.

ECG, Inc. would like to thank you for the opportunity to provide the COE with these services. If you have any questions, or require further information, please contact Chip Walberg or Russ Graham at (205) 235-2110.

Sincerely;
ECG, INC.

WILLIAM R. GRAHAM, PG, CES
SENIOR HYDROGEOLOGIST

HARRY G. SUMMERS, PE
VICE-PRESIDENT

ENVIRONMENTAL SITE ASSESSMENT

ORLANDO EXECUTIVE AIRPORT
ORLANDO, FLORIDA

US ARMY CORPS OF ENGINEERS, JACKSONVILLE DISTRICT

Prepared by:
ECG, Inc.
1317 Wilmer Street, Suite 102
Anniston, Alabama 36201

ISSUE DATE : JULY 15, 1996

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EXECUTIVE SUMMARY

ECG, Inc., under contract DACWIT-96-D-0009, Delivery Order No. 1 to the US Army Corps of Engineers, Jacksonville District, investigated a portion of the Orlando Executive Airport for impact from trichloroethylene (TCE) and benzene. The site was suspected of being the source of a plume detected on adjacent property.

The subject site, approximately forty (40) acres in size, is a portion of a larger site that was formerly used as an army air base and a naval training facility during and after the Second World War. The site is question is currently part of the Orlando Executive Airport, but is vacant. Operations were conducted at the site from 1940 through 1990, with the heaviest use from the mid-1950's to late-1960's. While the site was an air base, planes were stored and maintained at the site.

The subject site consists of 1.8 million square feet of vacant land in a mixed use area of Orlando, Florida, southeast of the executive airport terminal. The property is relatively flat, covered with various grasses and scrub weeds, and is surrounded by a fence limiting access. The site is bordered on the north and west by the airport and to the south and east by residential developments. An abandoned naval training facility borders the property to the northeast. The outlying areas are mixed commercial and residential, relatively flat, and contain many small lakes (figure i).

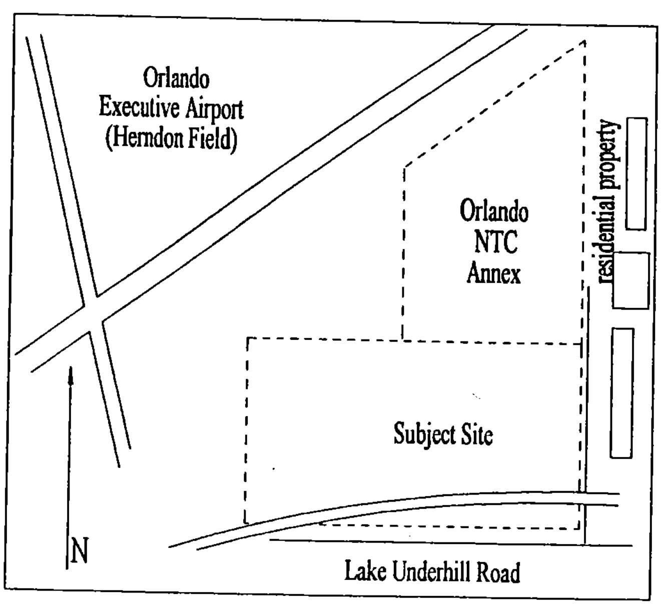


Figure i. Site Vicinity

Site geology consists of fine grained sandy soil underlain by fine grained sands, clays, and silts. Groundwater was encountered at a depth of approximately nine (9) feet below ground surface.

Historical aerial photographs revealed a continuous reworking of the northeast corner of the subject site, indicative of landfilling. A visual field reconnaissance revealed heavily stressed vegetation in this same area, and significant debris present on the surface.

Previous investigations had revealed PCE and benzene contamination in the soil at a depth of fifty (50) to sixty (60) feet below surface on the adjacent naval property to the northeast. High concentrations were also indicated in the groundwater. Contaminant plume modeling of results from the adjacent naval property suggested the source to be the subject site.

Given the results of modeling, historical aerial photography, and stressed site vegetation, the northeast corner of the subject site was sectioned into a grid and groundwater samples taken at intersections of gridlines, using Geo-Probe technology. Probe refusal was encountered in three (3) of the twenty (20) locations at approximately 25 feet in the northeast corner of the site, indicating potential buried debris. Groundwater at a depths of forty (40) feet and twenty (20) feet was sampled according to ASTM and EPA protocols. These groundwater samples were analyzed for TCE, PCE, and BTEX constituents using a HNu 311 field portable gas chromatograph (GC). The use of a field GC allowed for real time review.

Results of these analyses indicate trace amounts of TCE, PCE, and BTEX constituents present in the groundwater in the northeast corner of the site, but at concentrations well below established action limits. These trace concentrations are highest around a concrete hardstand, one of many in the area formerly used for aircraft parking, and in a small depressional area immediately downgradient from the hardstand. In samples upgradient and downgradient of the hardstand, concentrations drop below detection limits before reaching the boundary of the property.

Based on the data generated from sampling and analysis of the groundwater in the northeast corner of the site, no contamination from TCE, PCE, or benzene was found above established action limits in the upper forty (40) feet. The evidence suggests no causal links exist between the subject site contamination and that found on the adjacent naval property. However, additional groundwater investigations would be required at depths below forty (40) feet to confirm or deny any relation between this site and the adjacent naval property to the northeast.

1.0 INTRODUCTION

ECG, Inc., under contract DACWIT-96-D-0009 to the US Army Corps of Engineers, Jacksonville District, investigated a portion of the Orlando Executive Airport for impact from trichloroethylene (TCE), tetrachloroethylene, and benzene. The site was suspected of being the source of a plume detected on adjacent property.

The subject site, approximately forty (40) acres in size, is part of the Orlando Executive Airport, also known as Herndon Municipal Airport. The property was part of the former Orlando Army Air Field (Orlando Air Force Base) and is located in eastern Orlando, Florida. Prior to World War II, pilots for interceptor aircraft were trained at the facility. In 1942, a school for applied air tactics was established at the field. Training included testing various types of aircraft to determine the most effective use of each. No large contingent of any one craft was stationed there. While chemical warfare materials operations were part of this training, the actual chemical site was a remote facility several miles from the subject site.

In 1993, adjacent property located to the north, used as the US Navy Reserve Training Center Annex was determined to have been impacted by trichloroethylene (TCE), tetrachloroethylene (PCE), and benzene contamination. Contaminant plume modeling seemed to indicate a source south of that property. High concentrations of the target contaminants were indicated in the soil and groundwater at the southern boundary of the naval property.

The purpose of this investigation was to determine what impact, if any, past site activities may have had on the environmental integrity of the subject site and adjacent properties.

1.1 SCOPE OF WORK

Under the contract DACWIT-96-D-0009, ECG, Inc. is to provide to the US Army Corps of Engineers, Jacksonville District environmental support service at various sites within the jurisdiction. This assessment was delivery order No. 1. Relevant details of the scope of delivery order No. 1 included:

Historical aerial photographs of the property relating to past usage, if available, were located and reviewed. In addition to the National Archives in Washington, DC, and Aerial Photography in Salt Lake City, Utah, several other agencies were contacted for photographs. The objective of this task was to determine past activities at the site and locate the source of the contamination.

Based on the historical data review and a preliminary site visit, the investigation area was to be sectioned into fifty (50) foot squares. Groundwater samples were to be collected using hydraulic push probe (Geo-Probe) technology capable of retrieving groundwater samples from a depth of up to forty (40) feet below the ground surface at selected intersections of the gridlines. Twenty (20) groundwater samples were to be taken from a depth of forty (40) feet or shallower, depending on the location of a confining clay layer formation.

Each groundwater sample was to be analyzed for trichloroethylene and benzene using a field portable Gas Chromatograph (GC). The field GC allows real time analysis of the samples. The results of each sample were used to more effectively locate the next set of points. A final report was to be prepared containing a summary of the procedures, findings, results, and conclusions.

2.0 SITE CHARACTERISTICS

2.1 Physical Site Description

The City of Orlando is located in the Central Highland physiographic province of the Florida peninsula, approximately 45 miles from the Atlantic coast. The subject site is located in east southeast Orlando in a heavily urbanized and developed section of the city. The downtown city center is approximately five (5) miles to the west. More precisely, the site is located in the northwest corner of the intersection of Lake Underhill Road and Andes Drive, Section 28, Township 22 South, Range 30 East, Orlando East Quadrangle, USGS 7.5 Minute Series, 1956. photorevised 1980 (figure 1).

North and west of the subject site is the Orlando Executive Airport, also known as Herndon Airport. The airport is operated by the Greater Orlando Airport Authority, the current property owner. Property to the east and south of the site is currently utilized for single family residential developments. The East-West Freeway forms the actual southern boundary to the site. Adjacent property to the northeast was previously used as the Naval Reserve Training Center Annex, but is now vacant. The surrounding area is a mix of residential and commercial developments. The surrounding area contains two (2) large lakes; Lake Underhill to the southwest and Lake Barton to the northeast, and numerous small lakes and ponds.

The subject site consists of approximately 1.8 million square feet of currently vacant land, formerly used as part of an US Army air base and US Navy training center. The site is surrounded on all four sides by an eight (8) foot high chain link fence, limiting general access. There are no buildings on the property and the ground cover is predominantly grasses and scrub weeds. In addition to the vegetation, a paved road and a dirt road, formerly taxiways to the actual runway, cross the site east to west, and the site is dotted with paved "hardstands" used in the storing and maintenance of the airplanes formerly stationed at the base. These hardstands are four (4) inch thick concrete circles approximately fifty (50) feet in diameter, previously attached to the taxiways. The paved road leads from the gate to an Air Route Traffic Control Center maintained by the FAA.

The site is situated approximately 100 feet above mean sea level and is nearly level. Elevation rises gently to the west and south, rising approximately one (1) foot for every 100 feet of horizontal distance. To the southwest, the elevation crests and then begins to decrease at approximately the same slope. This small crest creates a drainage divide across the property (figure 2). Surface water runoff and shallow groundwater flow on the southern and western sections of the site ultimately drains into Lake Underhill; the northern and eastern sections of the site ultimately drain into Lake Barton.

The subject site is covered by many species of grasses and scrub weeds. Small trees grow along the fence lines. The majority of vegetation at the site appeared strong and healthy, but areas of stressed vegetation were noted at various places around the site. The largest patch of stressed vegetation occurred in the northeast corner of the subject site, with several species noted as dead or dying. This area of stressed vegetation occurred adjacent to a portion of the naval facility previously shown to be impacted by the target contaminants at a depth of fifty (50) to sixty (60) feet.

2.1.1 PHYSICAL SITE FEATURES

The only notable site features are the hardstands present from the time of the air base utilization. Each hardstand is approximately fifty (50) feet in diameter, and consists of approximately four (4) inches of concrete. The hardstand was placed in sections, rather than by continuous pouring, leaving seams between the sections. These hardstands were where the planes were parked when not in use. In addition, the planes were maintained, cleaned, and fueled on these hardstands. Any spills would run off the concrete or between the sections onto the ground below. There are numerous hardstands remaining at the site. Historical aerial photographs show evidence of other hardstands having been removed. These existing and removed hardstands are potential sources of the contamination.

2.2 SITE HISTORY

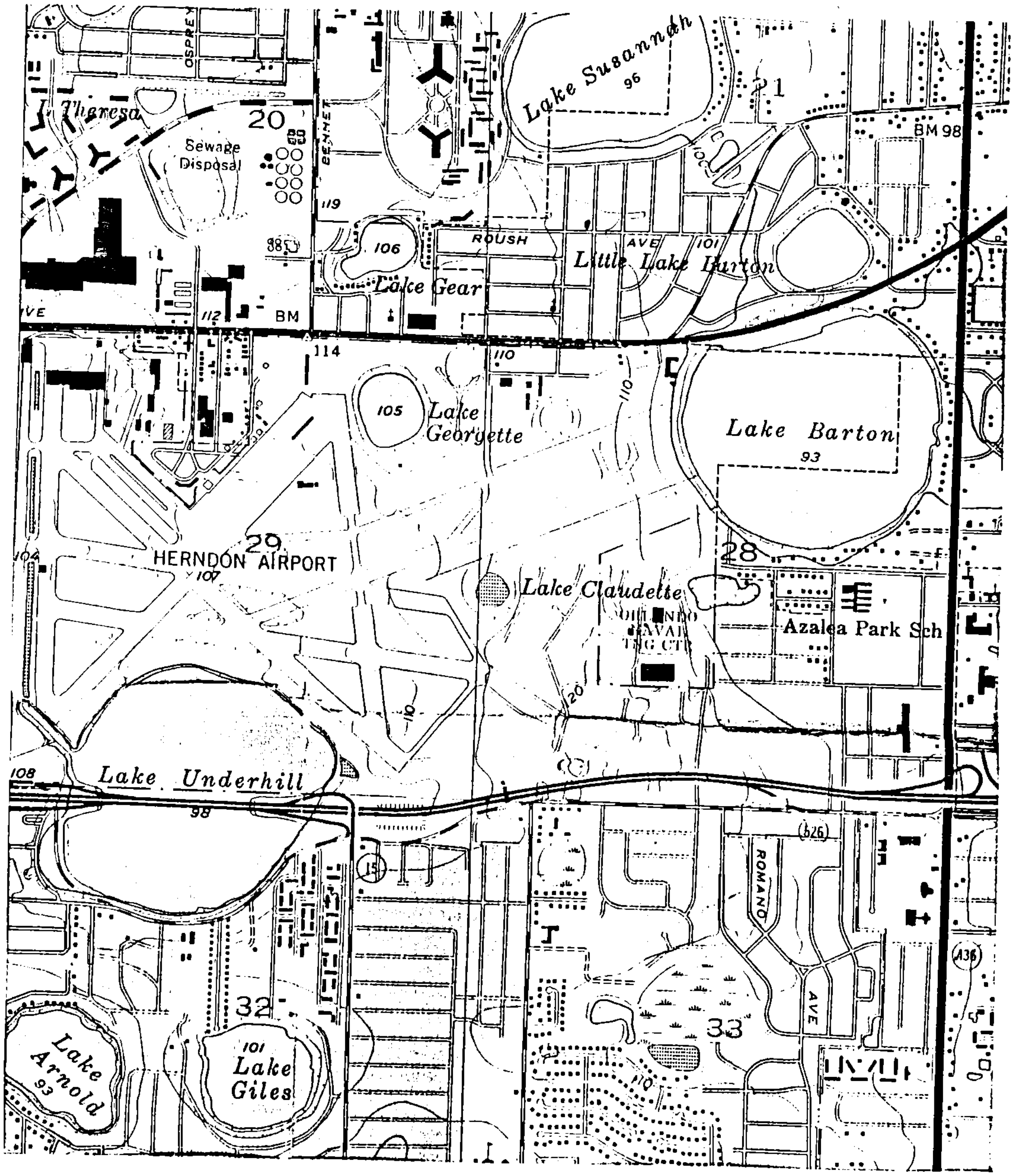
In December 1940, the US Army established the Interceptor Command School at the site. Prior to this time, the site was part of the Herndon Municipal Airport. In 1941, the US government obtained all the surrounding property including the subject site, incident to the establishment of the Applied Air Tactics School (AATS). Prior to the establishment of the school, only interceptor aircraft had been stationed at the site. Various aircraft were stationed at the site once the AATS was established. No large contingent of any one plane was ever stationed at the base. The AATS facility was deactivated in 1949, but the site remained an air base. In 1968, the US Air Force transferred the property to the US Navy. The site was used as a training facility annex to the Navy's main facility to the north. All military occupancy of the site was ended in 1990; the property returned to the city of Orlando and the Greater Orlando Airport Authority (GOAA).

2.2.1 PAST USES

Prior to development as Herndon Airport, the site was cultivated for citrus groves. In 1940, when acquired by the Department of Defense, the site was used as the Orlando Army Air Base. The site was used as a fire fighter training facility, but ceased operation in 1968. While the site was an air base, a photographic air wing was stationed there. The south section of the site, beyond the now constructed East-West Freeway, was allegedly used to empty the base dumpsters. The only military related materials that have been found at the site were old steel lockers and photography related materials.

2.2.2 CURRENT USES

The subject site is presently vacant land surrounded by an airport, an industrial park, an abandoned US Naval Reserve Center annex, various commercial business establishments, apartments, residential areas, and a park.



Environmental Site Assessment Orlando Executive Airport, Orlando, Florida

Figure 1

Scale 1:24000

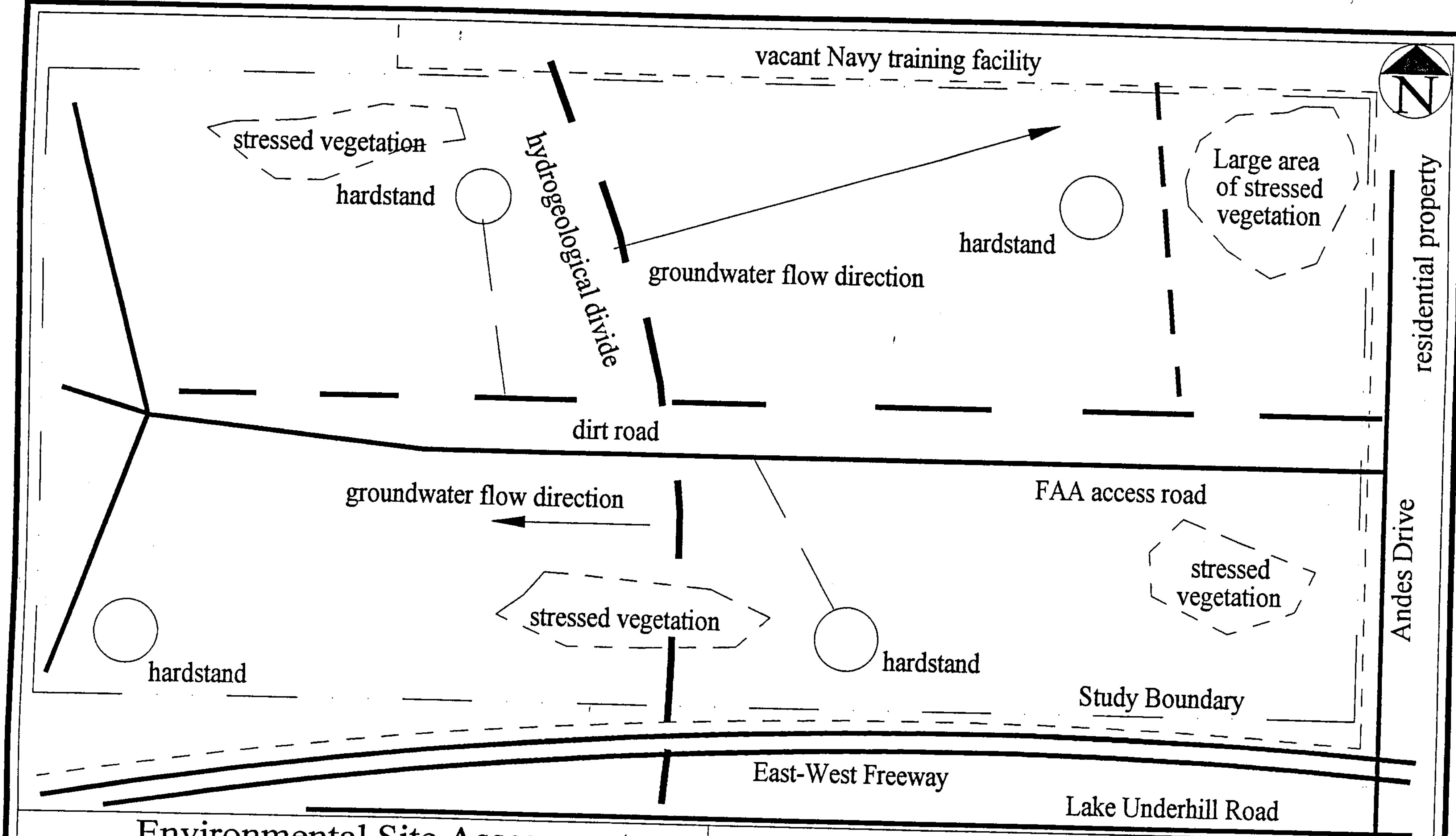
Vicinity Map, East Orlando, FL Area

Source: USGS 7.5 Minute Quadrangle; Orlando East, FL

ECG Engineering and Environmental Services
Anniston, Alabama

ECG Project Number: 2717-01

Prepared By: WRG 6/30/96	File Name: 2717011.skd	Final Approval: HGS
Checked By: CW 6/30/96	File Date: 6/30/96	



Environmental Site Assessment
Orlando Executive Airport,
Orlando, Florida

ECG Engineering and Environmental Services
Anniston, Alabama

Scale NTS

Figure 2

Generalized Site Map

ECG Project Number: 2717-01

Prepared By: WRG 6/30/96 | Checked By: CW 6/30/96 | File Name: 2717012.skd | File Date: 6/30/96 | Final Approval: HGS |

2.3 CONTAMINANT CHARACTERISTICS

2.3.1 TRICHLOROETHYLENE (TCE)

Trichloroethylene (TCE), also known as Trichloroethene is a clear, colorless, volatile liquid that is immiscible in water. It is miscible in alcohol, chloroform, or ether. TCE has an odor similar to ether or chloroform. It is man-made chemical that does not naturally occur in the environment. TCE is primarily used as a solvent to remove grease from metal parts. TCE has a powerful solvent action for fats, greases, and waxes, and is one of the most important chlorinated solvents for use in degreasing and dry-cleaning. A material safety data sheet detailing the hazards and precautions of TCE is included as appendix C of this report. Some of the general properties of TCE are:

Specific gravity:	1.46 (water = 1)
Boiling Point:	87° C
Melting Point:	-73° C
Auto-Ignition Temp:	410° C
Explosive Limits, vol% in air	8-10.5%
CAS#	79-01-6

TCE was first produced in 1864, but did not gain its current popularity as a useful chemical until the early 1900's. TCE has been produced in the United States since 1925.

2.3.1.1 Toxicology Profile

Preliminary evaluation of the carcinogenic activity of TCE in laboratory rodents by the National Cancer Institute (NCI) indicates that this material is a potent liver carcinogen. On March 21, 1975 the Associate Director of Carcinogenesis of the National Cancer Institute informed of the possible carcinogenicity of TCE. Subsequently, the NIOSH was informed by the NCI that an unusually high incidence of heptacellular carcinomas was observed in mice given TCE by gastric intubation. Because of the extensive use of TCE in commercial and industrial work environments, and the potential for cancer induction in humans, NIOSH is alerting the occupational health community as an integral part of its current intelligence system. Additional animal studies, as well as detailed epidemiological investigations, are ongoing and are anticipated for the future.

2.3.1.2 Exposure Routes

The two (2) main sources of human exposure to TCE are the workplace and the environment. TCE has been found in 460 of 1179 hazardous waste sites on the National Priorities List (NPL). Background levels of TCE can be found in the air and many lakes, streams, and groundwater used as sources of drinking water for many homes and businesses. Various federal and state surveys indicate that between nine (9) and 34 percent (9-34%) of the water supply sources in the United States may be contaminated with TCE. Water supplies that are impacted, typically contain an average of one (1) to two (2) parts TCE per billion parts water, or less. An important source of environmental release of TCE is evaporation into the atmosphere from work performed to remove grease from metal. In addition, TCE is released to the soil and groundwater as a result of leaks or spills.

2.3.1.3 Migration Potential

The migration of leaking contaminants is affected by the quantity of the leakage and the characteristics of local subsurface conditions. Small quantities may be retained by the soils around the source, while larger quantities will percolate away from the source.

Characteristics of the contaminant are important in predicting the reaction of a liquid within the soil in unsaturated and saturated zones. In the saturated zone, some substances will dissolve, while others will be immiscible. Immiscible substances with a specific gravity (S.G.) less than one (water =1) will be found only in the upper reaches of the saturated zone. The more dense substances (S.G.>1) will tend to move downward throughout the saturated zone. These dense substances are most likely to enter groundwater supplies and migrate to and through fractures in the impervious strata until confined by some impermeable layer.

2.3.2 TETRACHLOROETHYLENE (PCE)

Tetrachloroethylene is a man-made substance widely used for dry cleaning fabrics and textiles and for metal-degreasing operations. It is also used as a starting material (building block) for the production of other man-made chemicals. Other names that may be used for tetrachloroethylene include perchloroethylene, perc, PCE, perclene, and perchlor. Although tetrachloroethylene (PCE) is a liquid at room temperature, some of the liquid can be expected to evaporate into the air producing an ether-like odor; evaporation increases as temperature increases. A material safety data sheet detailing the hazards and precautions of PCE is included in appendix C of this report. Some of the general properties of PCE are:

Specific gravity:	1.62 (water = 1)
Boiling Point:	121° C
Melting Point:	-18.9° C
Auto-Ignition Temp:	NA
Explosive Limits, vol% in air	NA
CAS#	127-18-4

2.3.2.1 Toxicology Profile

In high concentrations in air, particularly in closed, poorly ventilated areas, single exposures to PCE can cause central nervous system (CNS) effects leading to dizziness, headache, sleepiness, confusion, nausea, difficulty in speaking and walking, and possibly unconsciousness and death. These symptoms occur almost entirely in work (or hobby) environments. The potential long-term health effects that might occur in humans from breathing PCE at levels lower than those that produce CNS effects, or from ingesting very low levels of the chemical found in some water supplies, have not been identified. The effects of exposing infants to PCE through breast milk are unknown.

Animal studies, conducted with amounts much higher than typical environmental levels, have shown that PCE can cause liver and kidney damage, liver and kidney cancers, and leukemia (cancer of the tissues that form the white blood cells). Developmental effects in fetuses have been observed, but only at PCE exposure levels that also produce toxicity in the maternal animal.

The U.S. Department of Health and Human Services has determined that PCE may reasonably be anticipated to be a carcinogen. Based on evidence from animal studies, PCE is thought to be capable of causing cancer in humans. It should be emphasized, however, that currently available information is not sufficient to determine whether PCE causes cancer in humans.

2.3.2.2 Exposure Routes

Humans can be exposed to PCE from environmental, consumer product, and occupational sources. Common environmental levels of PCE (often called background levels) are usually several thousand times lower than levels found in the workplace. Background levels found in the air and food and water result from evaporation from industrial or dry-cleaning operations or from releases from areas where chemical wastes are stored.. PCE has been found in at least 330 of the 1179 National Priorities List (NPL) hazardous waste sites.

Exposure to PCE may also occur from some consumer products. Products that may contain PCE include auto brake quieters and cleaners, suede protectors, water repellents, silicone lubricants, belt lubricants and dressings, specialized aerosol cleaners, ignition wire dryers, fabric finishers, spot removers, adhesives, and wood cleaners. Although uncommon, small amounts of PCE have been found in foodstuffs.

Because PCE evaporates quickly, the most common exposure to PCE comes from inhalation. PCE may also enter the body through drinking contaminated water or eating contaminated food. Because PCE does not pass through the skin to any significant extent, entry into the body by this path is of minimal concern, although skin irritation may result from repeated or prolonged contact with the undiluted liquid.

2.3.2.3 Migration Potential

The migration of leaking contaminants is affected by the quantity of the leakage and the characteristics of local subsurface conditions. Small quantities may be retained by the soils around the source, while larger quantities will percolate away from the source.

Characteristics of the contaminant are important in predicting the reaction of a liquid within the soil in unsaturated and saturated zones. In the saturated zone, some substances will dissolve, while others will be immiscible. Immiscible substances with a specific gravity (S.G.) less than one (water =1) will be found only in the upper reaches of the saturated zone. The more dense substances (S.G.>1) will tend to move downward throughout the saturated zone. These dense substances are most likely to enter groundwater supplies and migrate to and through fractures in the impervious strata until confined by some impermeable layer.

2.3.3 BENZENE

Benzene, also known as white gasoline, is a naturally occurring substance produced by volcanoes and forest fires and present in many plants and animals. Benzene is also a major industrial chemical made from coal and oil. As a pure chemical, benzene is a clear, colorless, sweet smelling liquid. In industry, benzene is used to make other chemicals, as well as some types of plastics, detergents, and pesticides. It is also a component of gasoline. A material safety data sheet detailing the hazards and precautions of benzene is included in appendix C of this report. Some of the general properties of benzene are:

Specific gravity:	0.88 (water = 1)
Boiling Point:	80.1° C
Melting Point:	5.5° C
Auto-Ignition Temp:	-11.1° C
Explosive Limits, vol% in air	1.2-7.8%
CAS#	79-43-2

2.3.3.1 Toxicology Profile

Benzene is harmful, especially to the tissues that form blood cells. Toxicological impacts are based on duration of exposure and the contraction of the source.

Death may occur in humans and animals after brief oral or inhalation exposures to high levels of benzene; however, the main effects of these types of exposures are drowsiness, dizziness, and headaches. These symptoms disappear after exposure stops.

From overwhelming human evidence and supporting animal studies, the U.S. Department of Health and Human Services has determined that benzene is carcinogenic. Leukemia (cancer of the tissues that form the white blood cells) and subsequent death from cancer have occurred in some workers exposed to benzene for periods of less than 5 and up to 30 years. Long-term exposures to benzene may affect normal blood production, possibly resulting in severe anemia and internal bleeding.

In addition, human and animal studies indicate that benzene is harmful to the immune system, increasing the chance for infections and perhaps lowering the body's defense against tumors. Exposure to benzene has also been linked with genetic changes in humans and animals.

Animal studies indicate that benzene has adverse effects on unborn animals. These effects include low birth weight, delayed bone formation, and bone marrow damage. Some of these effects occur at benzene levels as low as 10 parts of benzene per million parts of air (ppm). Although benzene has been reported to have harmful effects on animal reproduction, the evidence for human reproductive effects, such as spontaneous abortion or miscarriage, is too limited to form a clear link with benzene.

2.3.3.2 Exposure Routes

The three main types of exposure to benzene are environmental, consumer product, and occupational. The greatest possibility for high-level exposures is in the workplace, however, most people are exposed to benzene in tobacco smoke and automobile exhaust.

Benzene has been found in at least 337 of 1179 National Priorities List (NPL) hazardous waste sites. Other environmental sources of benzene include gasoline (filling) stations, vehicle exhaust fumes, tobacco smoke, underground storage tanks that leak, wastewater from industries that use benzene, chemical spills, groundwater next to landfills containing benzene, and food products that contain benzene naturally. In addition, certain industries may release benzene into the surrounding air. These include ethylbenzene- and styrene-production facilities, petroleum refineries, chemical manufacturing plants, and recovery plants for coke oven by-products.

Consumer products containing benzene include glues, adhesives, household cleaning products, paint strippers, some art supplies, tobacco smoke, and gasoline.

Occupational exposure to benzene can occur in the rubber industry, oil refineries, chemical plants, the shoe manufacturing industry, and gasoline storage, shipment, and retail stations.

2.3.3.3 Migration Potential

Characteristics of the contaminant are important in predicting the reaction of a liquid within the soil in unsaturated and saturated zones. In the saturated zone, some substances will dissolve, while others will be immiscible. Immiscible substances with a specific gravity (S.G.) less than one (water =1) will be found only in the upper reaches of the saturated zone. They tend to float on the water table surface and become adsorbed onto soil grains when the water table fluctuates. Light substances, (S.G.<1) are most likely to enter into the groundwater and begin to spread laterally due to capillary action between the soil grains. Migration in the unsaturated zone tends to be from grain to grain.

2.4 PREVIOUS INVESTIGATIONS

Four (4) additional investigations conducted at this or adjacent to this site were discovered in the course of this investigation. The most relevant investigation was conducted in 1993 on the property to the north owned by the Navy. The other three (3) investigation were conducted for reasons other than environmental concerns, and provided only general information. A section in the 1964 master plan for the Orlando Air Force Base mentions the southeast section of the municipal airport has been used as a landfill.

The investigation on the Navy property to the north of the site indicated contamination from PCE and benzene. Sample points along the north boundary of the subject site, north of the fence line revealed PCE in the groundwater at a depth of fifty (50) to sixty (60) feet below ground surface in concentration as high as 13 parts per billion (ppb) and benzene as high as 64 ppb. Monitoring wells located north of the subject site on the naval property, indicated benzene contamination as high as 320 ppb in samples from a depth of 55 feet. Contaminant plume modeling indicated the source of the plume potentially on this site.

3.0 SUBSURFACE ASSESSMENT

3.1 GEOLOGY

3.1.1 REGIONAL AND STRUCTURAL GEOLOGY

The site area is located in the central Floridian section of the Coastal Plain physiographic province. This peninsular area of Florida has been divided into three (3) physiographic zones: the Southern or Distal Zone, the Central or Mid-Peninsular Zone, and the Northern or Proximal Zone. The site falls entirely within the Central of Mid-Peninsular Zone, which is characterized by a series of ridges and valleys that parallel both the Atlantic coastline and the longitudinal axis of the peninsula.

The dominant influence on sedimentation in the study area has been the peninsular arch, a northwest trending feature that was continuously positive from the early Mesozoic (Jurassic) until the late Cretaceous time and was intermittently positive during the Cenozoic time. Southwest of and parallel to the Peninsular Arch is the Ocala Uplift, which affects only rocks of middle Eocene age and younger. The uplift is a gentle anticlinal flexure about 230 miles long and 70 miles wide, exposed near the surface in west-central Florida.

The west-central peninsula of Florida consists of igneous and metamorphic basement rocks overlain by 4000 feet of sedimentary rocks, principally limestone. These geologic units and descriptions of their general lithology are summarized in table 1 below.

TABLE 1 GENERAL STRATIGRAPHY OF THE ORLANDO AREA

AGE	STRATIGRAPHIC UNIT	LITHOLOGY
Post Miocene includes Pliocene, Pleistocene, and Holocene Series	Surficial Aquifer	marginal to shallow marine beds overlain by sandy marine terraces, capped by fluvial and/or residuum
late to Middle Miocene	Undifferentiated sand and clay and the HAWTHORNE FORMATION	highly variable sequence consisting of clay, silt, and sand beds
Early Miocene	absent	
Oligocene	absent	
Late Eocene	OCALA LIMESTONE	white to cream, soft, friable, porous coquina
Early to middle Eocene	AVON PARK FORMATION (includes the LAKE CITY LIMESTONE)	predominately brown limestone and dolomite of various textures
	OLDSMAR FORMATION	finely pelletal limestone interbedded with fine to medium grained crystalline dolomite
Paleocene	upper CEDAR KEYS FORMATION	coarsely crystalline dolostone, moderately to highly porous

3.1.2 SOILS

The parent material of the site soils consists of beds of sandy and clayey material that were transported by the sea, often covering the area during the Pleistocene. During the high stands of the sea, Miocene and Pliocene sediments were eroded and redeposited or were reworked on the shallow sea bottom to form terraces.

The majority of the site is underlain by nearly level to gently sloping, poorly drained to moderately well drained soils, sandy throughout, mostly marine in origin. The soils are classified as the Pomello and St. Lucie Urban-land complex. Some have organic stained subsoil at a depth of less than 30 inches, some as deep as 30-50 inches. Most areas have been modified for urban use. Surficial permeability if high, ranging from >6.0 inches per hour. Due to the fine grained sandy nature of the soil there is a high potential for sheet and rill erosion on slopes, otherwise the potential is slight due to the nearly level topography. Wind erosion is a high hazard on these sandy soils. These strongly acid soils are highly corrosive on uncoated steel. A detailed soil profile of the near surface soils at the site is shown in table 2.

TABLE 2 GENERAL SOIL PROFILE OF THE ORLANDO AREA

NEAR SURFACE SOIL PROFILE						
DEPTH (FT)	SOIL DESCRIPTION	PERCENTAGE PASSING SIEVE NUMBER			PERMEABILITY (IN/HR)	PLASTICITY INDEX
		#4	#40	#200		
0-0.5	Fine Sand, SP, SP-SM	100	85-100	2-10	> 6.0	NP
0.5-7	Sand, fine Sand, SP-SP-SM	100	85-100	2-10	> 6.0	NP

3.1.3 SITE SUBSURFACE

The subsurface at the subject site consists of fine sand at the surface grading into fine clayey sand with depth.

The surface layers consists of six (6) to eight (8) inches of dark brown, fine grained sand. Below this layer is approximately fifteen (15) feet of white to tan medium grained sand. From eighteen (18) feet to 25 feet, this sand contains more fine grained silt, and provided the most resistance to the probe. Below the silty sand was approximately 15 feet of interbedded silt, sand, and clay, gray to dark gray slightly plastic, and moist. Below the clay and silt interbeds, at approximately 35 to 40 feet bgs, clean white sand was encountered A typical boring log composite from all borings at the site can be found in Appendix A.

3.2 HYDROGEOLOGY

3.2.1 SURFACE WATER

Significant portions of the surrounding area have been developed into a highly urbanized area with the appropriate drainage systems. Surface water at the airport is directed into a series of drainage ditches and into the various retention ponds nearby, before being released into the natural drainage channels. The surface water then drains through these channels and drainage systems into the numerous surrounding lakes prior to being discharged into the Little Econolockhatchee River to the northeast.

The surficial aquifer, or water table aquifer, is found where poorly consolidated or unconsolidated clastic rocks overlie limestone and dolomites of the Floridan Aquifer. The thickness of the shallow aquifer is highly variable due to the variations in the thickness of the sands. The shallow aquifer may directly overlie the Floridan Aquifer or they may be separated by confining beds. Recharge to the water table aquifer is almost entirely from local rainfall, except in those areas where hydraulically connected to the deeper aquifer system. Discharge from the shallow aquifer may be by downward percolation into the Floridan aquifer, seepage into streams, lakes, sinkholes, and pumpage from wells. The shallow aquifer system is mainly used for small domestic supplies.

3.2.2 GROUNDWATER

Groundwater found in the study area occurs under two conditions, artesian and non-artesian. Artesian conditions occur in areas where the water is confined below some impermeable confining layer. In an artesian well water will rise to a level above where it was first encountered. Non-artesian conditions exist where the water in the zone of saturation is not confined and is therefore not under pressure; this is known as the water table aquifer. Two aquifer systems, the surficial, or water table aquifer, a non-artesian system; and the Floridan Aquifer, an artesian system; occur within the study area.

3.2.2.1 Non-Artesian Aquifer

The non-artesian aquifer is composed primarily of sands and shell with varying amounts of clay and hard pan. These deposits are generally referred to as undifferentiated sediments of Miocene to Recent age. The shallow aquifer system provides only limited quantities of water of highly variable quality. The thickness and character of the surficial aquifer are highly variable. Wells developed in this system are primarily used to water livestock and lawns with limited domestic household usage. The quality of the water depends greatly on the geology of the aquifer. The water may be hard or soft depending on the calcium carbonate content. Iron content may be high and pH may vary, often making the water corrosive.

3.2.2.2 Artesian Aquifers

The artesian systems are more important. There are two types of artesian aquifers found in the study area; secondary artesian aquifers and the Floridan Aquifer system.

The secondary artesian systems occur in undifferentiated sediments and more extensively in the Hawthorne Formation. These aquifers are composed of thin beds of limestone, discontinuous shell beds, and layers of sand and gravel. They generally yield less water than the Floridan Aquifer, but more than the non-artesian systems. The water is often less mineralized than the water from the Floridan system but more mineralized than the water from the surficial systems. The quality of the water varies with depth, location, and local geologic and hydrogeologic conditions. The secondary aquifers are the least likely to be impacted because overlying, low permeability beds protect them from surface pollution, and because drainage wells are usually cased through the secondary zone, into the deeper Floridan Aquifer.

The Floridan aquifer underlies all of Florida and is the principal aquifer supplying most of the water for the region. In the study area it is represented by the limestone and dolomites of the Upper Floridan aquifer which includes the Upper Cedar Keys Formation, Oldsmar Formation, Lake City Limestone, Avon Park Formation, and the Ocala Group Limestones.

The Floridan Aquifer is one of the most productive aquifers in the world, and may be 2000 feet in thickness. Water well FLA-OR-11, located approximately eight (8) miles east southeast of the site, indicates the Upper Floridan Aquifer is about 340 feet thick in the study area.

The lithologic and hydrologic characteristics of the aquifer are not consistent, and the aquifer consists of alternating strata of limestone, dolomite, and dolomitic limestone. The top of the Floridan Aquifer is defined as the first consistent limestone below which no clay beds occur. The configuration of the top of the aquifer is highly variable due to the erosion and dissolution of the limestone that form the upper surface. There are numerous solution cavities and solution channels found within the aquifer system, some of which may be as large as 90 feet across. The caverns and channels contain most of the water that flows through the aquifer system. The elevation of the top of aquifer ranges from slightly below sea level to more than 100 feet above sea level. Subsurface information for well FLA-OR-11 indicates the top of the aquifer at an elevation of about -48 feet (MSL). The regional direction of groundwater flow movement in the Floridan aquifer is from east to west.

Recharge of the Florida system occurs from the overlying water table aquifer in areas where there is direct contact, or through seepage through leaky confining beds between the Floridan and the water table aquifers. Recharge can occur where the limestone is exposed at the surface or overlain with thin veneer of sand, and where there are lakes, sinkholes, or rivers. Total recharge for the East Central Florida region has been estimated to be on the order of a billion (10^9) gallons per day.

Discharge of groundwater from the Floridan Aquifer system occurs by spring outflow, seepage into the St. Johns River, outflow to the Atlantic Ocean, outflow to other areas, and pumping within the region.

The quality of water obtained from the Floridan Aquifer system is variable. Geology is the most important factor influencing water quality, but poor quality water is often introduced through the drainage wells common to the area. Salt water is naturally found in the areas along the Atlantic Coast, and pumping in these areas may increase the encroachment of sea water and hasten salt water contamination of the aquifer system.
Yields from the Floridan Aquifer have been measured in the thousands of gallons per minute range, but lower values are more common. The aquifer produces more potable water than the secondary and non-artesian sources. This water is typically produced from the upper 1000 feet of the aquifer system. Most domestic and commercial supplies in the area are obtained from the Floridan system.

3.2.3 SITE HYDROLOGY

The subject site is relatively level with a slight rise to the west southwest. This elevational rise crests near the center of the subject site. Surface cover is predominantly bare ground to scrub grass. Locally ground cover is asphalt from paved roadways and abandoned hardstands. Rainfall will quickly infiltrate the soil and be taken up to replenish soil moisture. Excess rainfall will percolate downward recharging the surficial aquifer. There are no artificial impoundments or channels constructed at the site. Runoff will follow any natural path and over time has developed small rills and gullies along the margins of the site. Adjacent property is developed with drainage measures to collect the runoff once it leaves the site. The site occupies a topographic drainage divide. The northeastern sections of the site will drain into Lake Barton to the northeast. The southwestern sections of the site will drain into Lake Underhill to the west and southwest (figure 3).

3.3 GROUNDWATER SAMPLING AND ANALYSIS

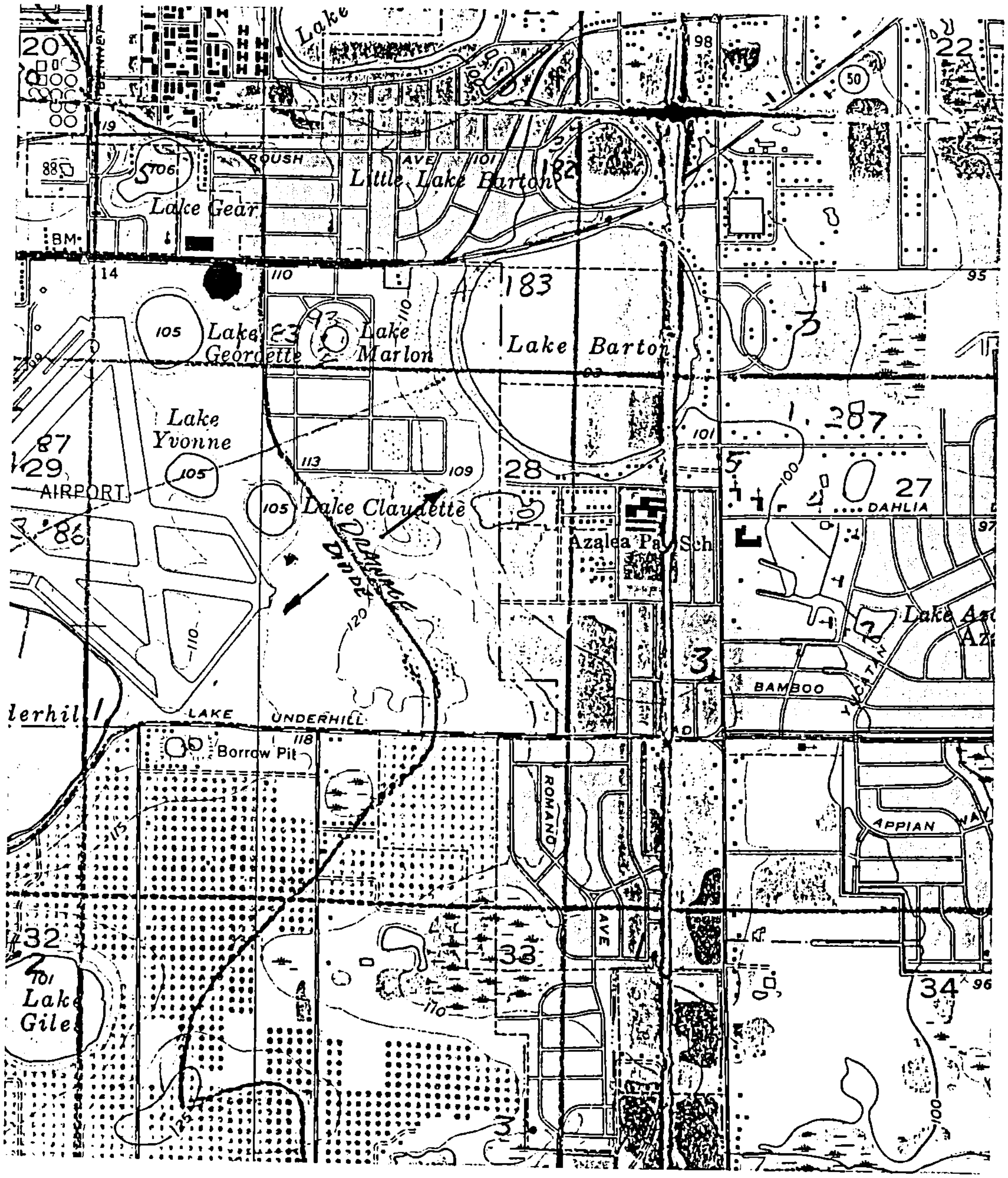
3.3.1 HISTORICAL DATA REVIEW

In order to locate the potential source prior to field investigations, readily available current and historical data was collected and analyzed. Sources for this data typically include federal, state, and municipal agencies such as the US Soil Conservation Service, the US Geological Survey, the State of Florida Geological Survey and Crop Forecast Office, the Orange County Engineers Office, and the City of Orlando Municipal Planning Office. In addition to the agency research, public and private archives such as the National Archives, the University of Florida Maps and Images Library, the Orlando Public Library, and the Orange County Historical Museum were contacted for information. A list of those agencies contacted in the course of this investigation can be found in the references section of this report.

Maps, aerial photographs, engineering and planning documents and reports, and professional publications from 1940 to the present, with emphasis on 1942 through 1968, were identified and researched for information regarding the source of the contaminant plume. Little information, other than general knowledge and historical background on the area, was obtained from the majority of the material reviewed. Historical aerial photographs revealed the most useful information. The northeast corner of the site appears to have been in a constant state of reworking during its history. The consistent feature on all aerial photographs was heavy scarring, indicative of earth moving, found in the northeast corner of the site, immediately south of the naval training facility. In several of these photographs, what appears to be earth-moving equipment can be observed.

In an attempt to get a general idea where the fire training area was located, individuals familiar with the history of the site were interviewed. No consistent location for the fire training area was determined from these interviews. Aerial photographs revealed no potential source, either.

N



Environmental Site Assessment
Orlando Executive Airport,
Orlando, Florida

ECG Engineering and Environmental Services
Anniston, Alabama

Figure 3 Scale 1:24000

Site Drainage

Source: USGS 7.5 Minute Quadrangle, Orlando East, FL

ECG Project Number: 2717-01

Prepared By: WRG 6/30/96	File Name: 2717013.dxf	Final Approval: HGS
Checked By: CW 6/30/96	File Date: 6/30/96	© Copyright 1996 ECG

3.3.2 SITE RECONNAISSANCE

The subject site consists of a rectangle oriented east-west on its long axis, having the dimensions of 1800 feet by 1000 feet, or approximately forty (40) acres.

Field reconnaissance was conducted prior to sampling activities to aid in locating the source of the plume. The site was visually surveyed from the ground to identify anomalies, such as dead vegetation, stained soils, depressions, or debris at the surface which would indicate past disturbance or impact.

The northeast corner of the site is somewhat lower topographically than the remainder of site. Approximately 100 feet south of the fence line, a pronounced depressed area having a regular shape was noted.

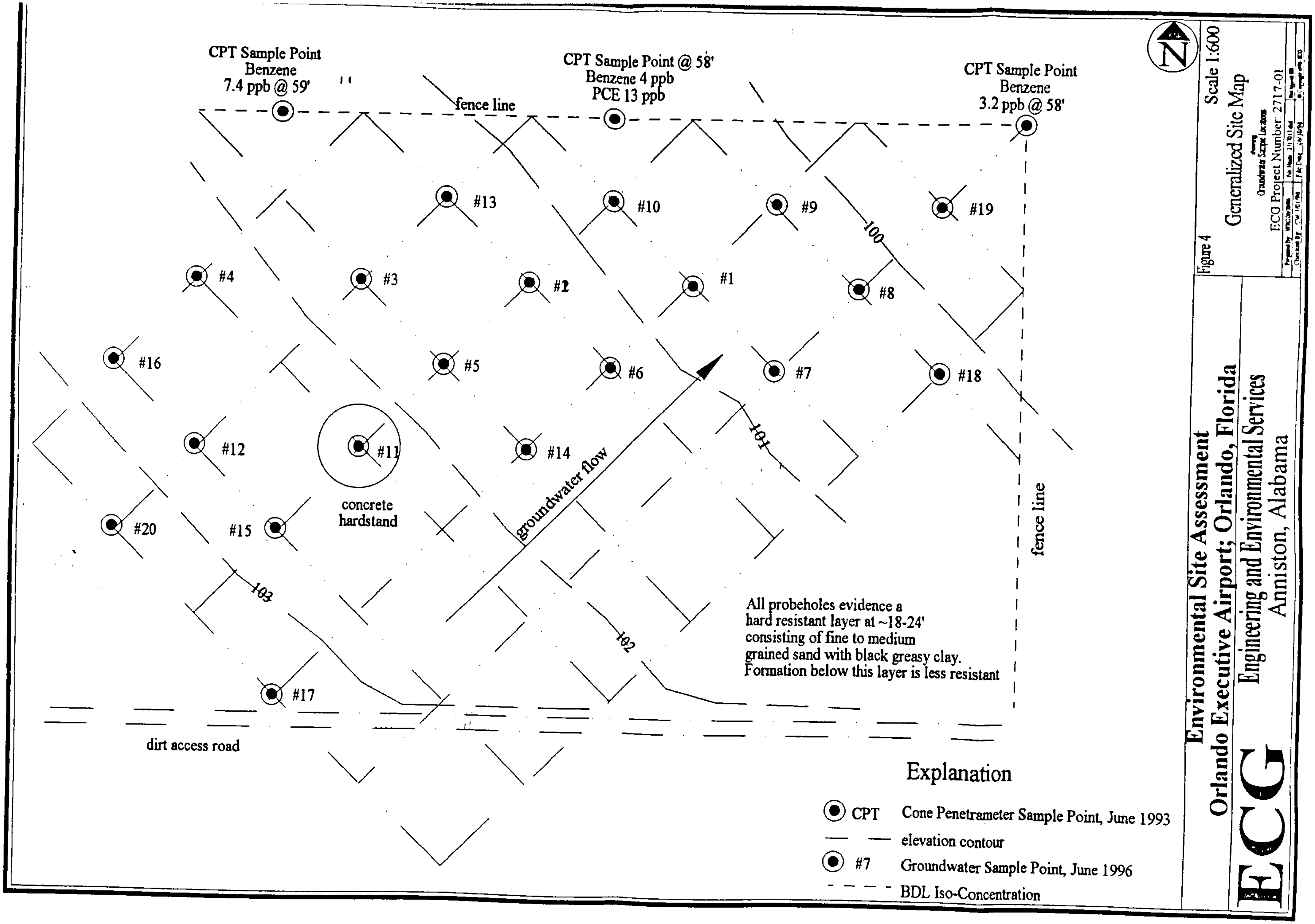
Several areas of scorched soil were noted at the site. Additional investigation revealed clean soil a few inches below the scorch marks, indicating these were due to small, recent surface fires.

Several areas of distressed vegetation were noted at the site. These areas were characterized by a close growing woody vine that was dead. The largest of the area of stressed vegetation was found in the northeast corner of the site immediately south of the naval reserve facility. Not only was the close growing woody vine dead, several other species of grasses evidenced signs of distress, such as stunted growth and yellowed leaves. In addition, several other species of grasses were noted to be abnormally abundant and healthy in the area. This area also included bits of debris such as cans and lids, broken plastic, broken pieces of wood and rusted metal.

Because of these features, the northeast corner of the site was selected as the starting point for the investigation. Sample points are referenced from the fence post in the northeast corner.

3.3.3 SAMPLING METHODOLOGY

Using a fiberglass measuring tape 100 feet in length and the northeast corner of the fence as a bench mark, sample points were established at the intersection of grid lines drawn across the northeast section of the site. Each sample point was flagged by a orange survey marker. Figure 4 illustrates sample point locations.


CPT Sample Point
Benzene
7.4 ppb @ 59'
CPT Sample Point @ 58'
Benzene 4 ppb
PCE 13 ppb
CPT Sample Point
Benzene
3.2 ppb @ 58'
fence line
N
#13
#10
#9
#19
100
#4
#3
#2
#1
#8
#16
#5
#6
#7
#18
#12
#11
#14
101
concrete
hardstand
groundwater flow
#20
#15
fence line
103
102
All probeholes evidence a
hard resistant layer at ~18-24'
consisting of fine to medium
grained sand with black greasy clay.
Formation below this layer is less resistant
#17
dirt access road
Explanation
CPT Cone Penetrameter Sample Point, June 1993
elevation contour
#7 Groundwater Sample Point, June 1996
BDL Iso-Concentration
Scale 1:600
Generalized Site Map
ECG Project Number: 2717-01
Figure 4
Environmental Site Assessment
Orlando Executive Airport; Orlando, Florida
ECG
Engineering and Environmental Services
Anniston, Alabama

Those points on figure 4, labeled as cone penetrameter (CPT) sample points, are from the previous investigation on the adjacent property to the north and are used as indicators and markers. That investigation was conducted in June 1993.

The Geo-Probe rig was positioned over the sample location. An expendable point was attached to the screened section of the probe tool. This point was left down hole when the screen was deployed to sample. The probe end was attached to a short joint of probe stem to assist in driving the initial three (3) feet of probe rod. Each section of probe rod is threaded at each end, three (3) feet long, has an outer diameter of $^5/_8$ inches, and an inner diameter of approximately ½ inch. Rods were driven by the weight of the rig, hydraulic push from the probe head, and by the percussion action of the pneumatic hammer. As each rod section was driven, another three (3) foot section was attached at the top and driven down.

Once the probe reached the desired depth, the rod stem was retracted approximately two (2) feet. Jointed, thin aluminum rods are inserted inside the probe rod and attached in a length equal to the depth. The screen at the bottom of the probe rod is deployed by applying force to the inner rods to drive the screen out of its housing. The screened sections allows water to flow into the probe rods, and rise to the potentiometric surface of the site. The inner rods were removed, placed on an impermeable liner, and set aside for decontamination. Water levels were taken with an electronic water level indicator at selected points.

Clean, disposable polyethylene tubing was then inserted in the probe rod to the depth of the screen. The tubing was connected to a peristaltic pump at the surface and a sample was drawn into the tubing. To maximize sample representation, approximately ½ liters were passed through the tubing prior to sampling. The pump was stopped, trapping the sample inside the tubing, and the tubing was quickly withdrawn from the rod. By sampling in this manner, the bottom of the groundwater column can be accurately sampled. The pump was reversed sending the sample out the end of the tubing. To minimize the potential for cross contamination during sample retrieval, approximately two (2) sample volumes were ejected from the sample tubing prior to sampling. Samples were collected in clean, new, 40 mL VOA vials supplied by a laboratory. The pump rate was increased to allow a small volume of the sample to flow into the sample vial. Care was taken not to allow headspace in the sample vials. Two (2) vials of each sample were collected. The sample tubing was discarded. The vial was sealed to allow for no headspace above the sample. The vials were immediately chilled to 4°C until analysis.

The rods and screen were then retracted. Each section was removed at the top and set aside for decontamination. Once the screened section was raised to a depth of twenty (20) feet, another groundwater sample was taken. These shallow samples effectively sample the top of the groundwater column. New tubing was inserted, and attached to the pump. To minimize the potential for cross contamination from the deeper sample, the screen was purged of approximately four (4) liters prior to sampling. The same sampling procedure was used for the samples at twenty (20) feet as those for the deeper samples. The entire string of probe rods was then removed from the hole, and set aside for decontamination.

3.3.3.1 DECONTAMINATION

The probe string and all tools used down hole were decontaminated between each sample location using a laboratory grade detergent, de-ionized water, a potable water rinse, and air dried in the sun. All purge water and decontamination wash water was collected in buckets at each location, and transferred to a central drum for later analysis and disposal as necessary. All tools used down hole were staged on six (6) mil plastic sheeting as a barrier to further contamination. Solid waste and debris was removed from the site daily. Once analyzed and found to be uncontaminated, the purge and wash water were released at the site.

3.3.4 RESULTS OF ANALYSES

3.3.4.1 Analytical Procedure

Each sample of groundwater, twenty (20) foot and forty (40) foot, for each location was analyzed with an HNu 311 field portable Gas Chromatograph (GC) for trichloroethylene (TCE), tetrachloroethylene (PCE), and benzene, toluene, ethylbenzene, and xylene (BTEX) contaminants to provide real time review of results.

The field analysis instrument consisted of the extraction unit, the Gas Chromatograph, and the detection unit, in this case a photo ionization detector (PID) with a lamp setting of 10.8 eV. The sensitivity of the HNu 311 is on the order of one (1) to two (2) parts per billion.

The sample was injected into the extraction chamber, where all compounds in the sample are extracted using solvents that will not skew the process. The retention time of a compound, that is the time between initial injection and initial detection, is a function of the compound. A known amount of time will pass before a particular compound will be detected. Once the compound moved into the detection unit, the PID measured the amplitude of the ionization potential. By measuring the amplitude of a compound at a known retention time, and converting the amplitude with a simple equation, the concentration of the compound can be determined.

The GC was calibrated according to manufacturers instructions twice daily. Solutions of standardized concentrations were tested randomly to provide an accurate check on calibration stability. The additional sample vial is retained for future analysis or laboratory confirmation, if required.

3.3.4.2 Analytical Results

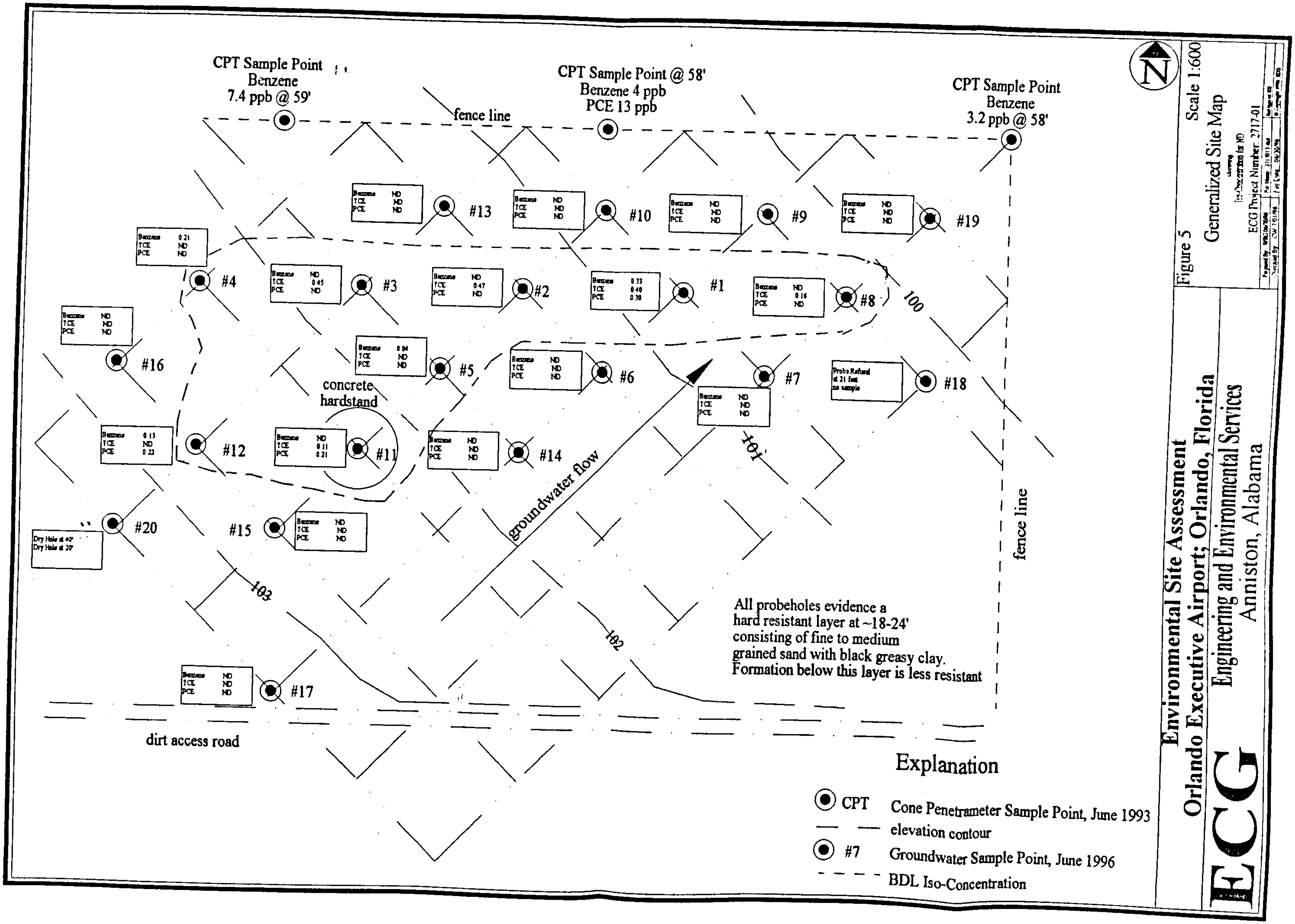
The results of sample analyses indicate concentrations of TCE, PCE and BTEX constituents present only in trace amounts, well below the action limits established by the Florida Department of Environmental Protection. The highest field GC reading indicated at concentration of 0.47 ppb TCE in the water at a depth of 27 feet bgs at sample point #1. This sample point revealed the highest concentrations of the other target contaminants as well.

Due to probe refusal and the dynamics of this type of sampling, only one sample was taken at points one (P1) through three (P3) and points five (P5) and six (P6). Due to probe refusal and dry hole conditions, no samples were obtained from points P18 and P20.

Any plume appears to be limited to the areas immediately around points P1 through P4, and P8. No contaminants were detected in sample points downgradient from these. The source of this plume would seem to be the hardstand immediately upgradient to these points. Samples from beneath the hardstand and immediate adjacent to it revealed TCE and PCE, but at concentrations well below established action limits.

Since the data indicated a plume with the hardstand as a source, the second sample from point P11 at forty (40) feet and two (2) others immediately upgradient, P15 and P17, were sent to an independent laboratory for confirmation. No contaminants were detected.

Results of these analyses are plotted and displayed graphically in figure 5. Sample results for TCE, PCE, and benzene are displayed on Tables 3 below. GC strip charts and laboratory originals can be found in Appendix B of this report.



CPT Sample Point
Benzene
7.4 ppb @ 59'
CPT Sample Point @ 58'
Benzene 4 ppb
PCE 13 ppb
CPT Sample Point
Benzene
3.2 ppb @ 58'
fence line
Benzene ND TCE ND PCE ND
#13
Benzene ND TCE ND PCE ND
#10
Benzene ND TCE ND PCE ND
#9
Benzene ND TCE ND PCE ND
#19
Benzene 0.21 TCE ND PCE ND
#4
Benzene ND TCE 0.45 PCE ND
#3
Benzene ND TCE 0.47 PCE ND
#2
Benzene 0.33 TCE 0.40 PCE 0.30
#1
Benzene ND TCE 0.16 PCE ND
#8
100
Benzene ND TCE ND PCE ND
#16
Benzene 0.84 TCE ND PCE ND
#5
Benzene ND TCE ND PCE ND
#6
#7
Benzene ND TCE ND PCE ND
Probe Refusal at 21 feet no sample
#18
concrete hardstand
Benzene 0.13 TCE ND PCE 0.22
#12
Benzene ND TCE 0.11 PCE 0.21
#11
Benzene ND TCE ND PCE ND
#14
101
groundwater flow
#20
Dry Hole at 40'
Dry Hole at 20'
#15
Benzene ND TCE ND PCE ND
103
102
fence line
All probeholes evidence a hard resistant layer at ~18-24' consisting of fine to medium grained sand with black greasy clay. Formation below this layer is less resistant
Benzene ND TCE ND PCE ND
#17
dirt access road
Explanation
CPT Cone Penetrameter Sample Point, June 1993
elevation contour
#7 Groundwater Sample Point, June 1996
BDL Iso-Concentration
N
Scale 1:600
Figure 5
Generalized Site Map
ECG Project Number: 2717-01
Environmental Site Assessment
Orlando Executive Airport; Orlando, Florida
ECG Engineering and Environmental Services
Anniston, Alabama

TABLE 3 RESULTS OF FIELD SCREENING

Sample Point	Results						Laboratory Confirmation
	20 feet			40 feet			
	TCE	PCE	Benzene	TCE	PCE	Benzene	
1 (27 feet)				0.4	0.30	0.33	
2 (24 feet)				0.47	ND	ND	
3				0.45	ND	ND	
4	ND	ND	0.21	ND	ND	ND	
5				ND	ND	0.04	
6				ND	ND	ND	
7	ND	ND	ND	ND	ND	ND	
8	0.16	ND	ND	ND	ND	ND	
9	ND	ND	ND	ND	ND	ND	
10	ND	ND	ND	ND	ND	ND	
11	0.11	0.21	ND	ND	ND	ND	ND at 40'
12	ND	ND	0.13	ND	0.22	ND	
13	ND	ND	ND	ND	ND	ND	
14	ND	ND	ND	ND	ND	ND	
15	ND	ND	ND	ND	ND	ND	ND at 40'
16	ND	ND	ND	ND	ND	ND	
17	ND	ND	ND	ND	ND	ND	ND at 40'
18	Probe refusal at 21 feet						
19	ND	ND	ND	ND	ND	ND	
20	Dry Hole at 20 and 40 feet						

ppb .....parts per billion
ND ......not detected

4.0 CONCLUSIONS

A currently vacant portion of the Orlando Executive Airport, formerly utilized as an Air Force base and Navy training center, was investigated for impact due to TCE, PCE, and benzene contamination. A previous investigation on adjacent property to the north had revealed contamination at depths of approximately 55 feet bgs, and plume modeling indicated the source potentially on this site. Historical research including aerial photograph review indicated the potential for landfilling operations and fire training exercises conducted at the subject site. This investigation took the form of groundwater sampling at a depth of twenty (20) and forty (40) feet below the ground surface at twenty (20) discrete sample locations within the southeast corner of the airport property. Samples were retrieved using Geo-Probe technology and analyzed by field portable GC for trichloroethylene (TCE), tetrachloroethylene (PCE) and benzene, toluene, ethylbenzene, and xylene (BTEX). Selected duplicate samples were sent to an independent laboratory for confirmation.

Results of the sampling indicate a contaminant plume, whose source appears to be the existing hardstand located in the northeast corner of the site, and possibly a hardstand no longer present at the site. The plume however, appears limited to an area approximately 4000 feet square around the hardstand and the area immediately downgradient. Trace amounts of TCE, PCE, and Benzene are present, but at concentrations well below action limits established by the Florida Department of Environmental Protection. Upgradient and downgradient groundwater samples indicated concentrations below detection limits before the boundaries of the property are reached.

5.0 RECOMMENDATIONS

Based on data accumulated from sampling and analysis of the groundwater at this site, no contamination from TCE, PCE, or benzene was found in the upper forty (40) feet of the site that exceeds the established action limits.

However, it should be re-iterated that adjacent property to the northeast, apparently downgradient from the subject site has been shown to be impacted with PCE and benzene. These contaminants were discovered at a depth of fifty (50) to sixty (60) feet below ground surface.

The present scope of work was not sufficient to investigate this site to those depths. Additional investigations would be required to determine the deeper groundwater conditions of this site.

QUALIFICATIONS

Our professional services have been performed and our recommendations prepared in accordance with generally accepted and customary principles and practices in the fields of environmental science and engineering. ECG is not responsible for the independent conclusions, opinions, or recommendations made by others based on the data, field explorations, and laboratory test data presented in the report.

The present study included a limited number of test borings across the entire project site. While the conclusions drawn from this investigation are considered reliable, there may exist localized variations in subsurface conditions that have not been completely defined at this time. It should be noted that subsurface conditions will be better delineated with increasing subsurface investigations.

The findings in this report depict subsurface and soil conditions only at these specific locations and the particular time designated on the logs. Additionally, time may result in a change in the environmental characteristics at this site and surrounding properties.

Given the nature of the operations conducted at and adjacent to this facility, it is apparent that additional information would be useful and necessary to provide a more accurate environmental assessment of the property. All areas identified in the previous section have the potential to be a substantial source of contamination.

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LITERATURE REVIEW

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HISTORICAL DATA COLLECTION

National Archives
National Geodetic Survey
Earth Science Information Center
USDA Soil Conservation Service
US Geological Survey
University of Florida Maps and Images Library
Florida Crop Statistics Office
Orange County Historical Museum
Greater Orlando Airport Authority
Orlando Public Library
Esquire Aerial Photographers
Continental Aerial Photographers

APPENDIX A
TYPICAL BORING LOG

Sample Number	Sample Type	Sample Recovery	Sample Depth (ft)	Detailed Sample Description	Natural Moisture Content (□ P.L.% ○ L.L.%; Scale: 0 20 40 60)	Penetrometer (TSF)	OVA/PID/FID	Remarks
			0–0.5	sandy soil, brown to black some silt; four (4) to six (6) inches				
			5, 10	Silty quartz Sand tan to brown, fine to medium grained				
			15	Silty quartz Sand black fine grained				
			20, 25, 30	Sandy Silt Dark Brown to gray fine to medium grained grades into silty quartz sand medium brown fine to medium grained				
			35, 40	Silty quartz Sand medium brown dark brown clayey lenses				

Note: Stratification Lines are approximate; in-situ transitions may be gradational

Agency ID #	Boring # typical log composite of all probe holes	Boring Location see figure 4	Page : 1 of 1	Auger Depth 40' Driller PVC/ABB Rig Type
			Date 6/10-14/96	Rotary Depth ____ Geologist WRG Geo-Probe
ECG Project # 2717-01	Site Location Orlando Executive Airport		Time: Start Finish	▼ Groundwater Depth During Drilling ____
				▽ Groundwater Depth After Drilling 8-11'

ECG

ENVIRONMENTAL SOIL BORING LOG

ECG Engineering and Environmental Services, Anniston, Alabama

Note: Boring Backfilled and sealed unless otherwise noted

Prepared By: WRG 6/30/96	File Name : 2717log.skd	Final Approval: HGS
Checked By: CW6/30/96	File Date : 6/30/96	

APPENDIX B
FIELD ANALYTICAL RESULTS AND LABORATORY CONFIRMATION

Operator: Marc Hawes
Date: 6/11/96

Project: ECG
Project #: 09708.00
Detector Lamp: 10.2 ev

Column: Packed
Column Pressure: 20 psi
Carrier Gas: Nitrogen

Sample ID	Collection Date	Run #	Matrix	Injection (ul)	Benzene (ppb)	EBZ (ppb)	Toluene (ppb)	Xylenes (ppb)	DCE (ppb)	TCE (ppb)	PCE (ppb)	Total Peaks	Remarks
													Xylene P Area = 215248 @ 8:18
													Xylene M Area = 196188 @ 8:58
													Xylene O Area = 115545 @ 10:22
20 ppb BTEX	—	22	AQU	200	20	20	20	60				13	Benzene Area = 198196 @ 1:44
													Toluene Area = 203684 @ 3:44
													Ethylbenzene Area = 225141 @ 7:18
													Xylene P Area = 226898 @ 8:18
													Xylene M Area = 204953 @ 8:58
													Xylene O Area = 132974 @ 10:22
10 ppb TCE	—	23	AQU	200						10			Area = 119351 @ 2:04
Column Blank	—	24	—	—								2	
Column Blank	—	25	—	—								—	BDL
Sample #3-1	6/11/96	26	AQU	200	BDL	2.52	< 1	5.18	—	< 1	BDL	11	Xylene P = 1.13, Xylene M = 1.51, Xylene O = 2.54
Sample #2-1	6/11/96	27	AQU	200	BDL	3.03	< 1	2.11	—	< 1	BDL	8	Xylene O = 2.11
Sample #1-1	6/11/96	28	AQU	200	< 1	2.54	< 1	4.87	—	< 1	< 1	14	Xylene P = 1.25, Xylene M = 1.32 Xylene O = 2.30
20 ppb BTEX	—	29	AQU	200	20	20	20	60				11	Benzene Area = 218149 @ 1:44
													Toluene Area = 218449 @ 3:44
													Ethylbenzene Area = 218842 @ 7:18
													Xylene P Area = 223451 @ 8:18
													Xylene M Area = 202713 @ 8:58
													Xylene O Area = 120429 @ 10:22
Sample #6-1	6/11/96	30	AQU	200	BDL	1.61	.47	3.28	—	BDL	BDL	7	Xylene P = .92, Xylene M = .81 Xylene O = 1.55
Sample #5-1	6/11/96	31	AQU	200	< 1	< 1	BDL	< 1	—	BDL	BDL	5	Xylene P = < 1
10 ppb PCE	—	32	AQU	200							10	8	Area = 143784 @ 4:10
10 ppb PCE	—	33	AQU	200							10	5	Area = 136009 @ 4:10
10 ppb BTEX	—	34	AQU	200	20	20	20	60				11	Benzene Area = 205126 @ 1:44
													Toluene Area = 202969 @ 3:44
													Ethylbenzene Area = 204097 @ 7:20

GC Operator: Marc Hawes
Date: 6/12/96

Project: ECG
Project #: 09708.00
Detector Lamp: 10.2 ev

Column: Packed
Column Pressure: 20 psi
Carrier Gas: Nitrogen

Sample ID	Collection Date	Run #	Matrix	Injection (ul)	Benzene (ppb)	EBZ (ppb)	Toluene (ppb)	Xylenes (ppb)	DCE (ppb)	TCE (ppb)	PCE (ppb)	Total Peaks	Remarks
#4 - 20'	6/12/96	4	GW	200	<1	BDL	BDL	BDL	—	BDL	BDL	3	
#7 - 40'	6/12/96	5	GW	200	BDL	BDL	<1	BDL	—	BDL	BDL	3	
#7 - 20'	6/12/96	6	GW	200	BDL	BDL	BDL	BDL	—	BDL	BDL	2	
#4 - 40'	6/12/96	7	GW	200	BDL	BDL	BDL	BDL	—	BDL	BDL	1	
#12 - 40'	6/12/96	12	GW	200	BDL	1	<1	BDL	—	BDL	<1		
#11 - 40'	6/12/96	13	GW	200	BDL	1.5	<1	2.2	—	BDL	BDL	7	Xylene m = 1.0 Xylene o = 1.2
#12 - 20'	6/12/96	14	GW	200	<1	1.6	<1	BDL	—	BDL	BDL	9	
#11 - 20'	6/12/96	15	GW	200	BDL	1.7	<1	<1	—	<1	<1	10	Xylene p <1
#9 - 20'	6/12/96	19	GW	200	BDL	<1	BDL	BDL	—	BDL	BDL	5	
#9 - 40'	6/12/96	20	GW	200	BDL	<1	BDL	BDL	—	BDL	BDL	3	
#8 - 20'	6/12/96	21	GW	200	BDL	<1	<1	BDL	—	<1	BDL	6	
#8 - 40'	6/12/96	22	GW	200	BDL	BDL	BDL	BDL	—	BDL	BDL	2	
#10 - 20'	6/12/96	24	GW	200	BDL	BDL	BDL	BDL	—	BDL	BDL	2	
#10 - 40'	6/12/96	25	GW	200	BDL	BDL	BDL	BDL	—	BDL	BDL	2	
#13 - 20'	6/12/96	26	GW	200	BDL	BDL	BDL	BDL	—	BDL	BDL	2	
#13 - 40'	6/12/96	27	GW	200	BDL	BDL	BDL	BDL	—	BDL	BDL	2	

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Column: Packed
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Sample ID	Collection Date	Run #	Matrix	Injection (ul)	Benzene (ppb)	EBZ (ppb)	Toluene (ppb)	Xylenes (ppb)	DCE (ppb)	TCE (ppb)	PCE (ppb)	Total Peaks	Remarks
#14-40'	6/13/96	9	GW	200					—			1	BDL
#15-20'	6/13/96	10	GW	200					—			1	BDL
#15-40'	6/13/96	11	GW	200					—			0	BDL
#14-20'	6/13/96	12	GW	200					—			0	BDL
#16-20'	6/13/96	13	GW	200					—			3	BDL
#16-40'	6/13/96	14	GW	200	<1				—			2	
#17-20'	6/13/96	17	GW	200			<1					10	
#17-40'	6/13/96	18	GW	200			<1					9	

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Date: 6/14/96

Project: ECG
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Detector Lamp: 10.2 ev

Column: Packed
Column Pressure: 20psi
Carrier Gas: Nitrogen

Sample ID	Collection Date	Run #	Matrix	Injection (ul)	Benzene (ppb)	EBZ (ppb)	Toluene (ppb)	Xylenes (ppb)	DCE (ppb)	TCE (ppb)	PCE (ppb)	Total Peaks	Remarks
Column Blank	—	1	—	—									
Syringe Blank	—	2	Air	200								—	BDL
Syringe Blank	—	3	Air	200								2	
Syringe Blank	—	4	Air	200								3	try new syringe
Syringe Blank	—	5	Air	200								7	try new syringe
Column Blank	—	6	—	—								7	
Syringe Blank	—	7	Air	200								—	BDL, try new syringe
#19-40'	6/14/96	8	GW	200		3.71*	<1					3	* Probably a ghost peak from syringe
#19-20'	6/14/96	9	GW	200		4.73*	<1						* Probably a ghost peak from syringe
Syringe Blank	—	10	Air	200								9	a ghost peak matches up w/ EBZ time